

Output tables for the test of Multiple comparisons.

December 17, 2022

1 Average rankings of Friedman test

Average ranks obtained by applying the Friedman procedure

Algorithm	Ranking
MEABC	6.1034
ABCADDE	3.9655
ABCNG	4.7586
SHADE	3.5172
MAPSO	4.8621
TAPSO	3.2759
MEEABC	1.5172

Table 1: Average Rankings of the algorithms

Friedman statistic considering reduction performance (distributed according to chi-square with 6 degrees of freedom: 78.70936.
P-value computed by Friedman Test: 4.016320609423474E-11.

2 Post hoc comparisons

Results achieved on post hoc comparisons for $\alpha = 0.05$, $\alpha = 0.10$ and adjusted p-values.

2.1 P-values for $\alpha = 0.05$

i	algorithms	$z = (R_0 - R_i)/SE$	p	Holm
21	MEABC vs. MEEABC	8.084148	0	0.002381
20	MAPSO vs. MEEABC	5.895958	0	0.0025
19	ABCNG vs. MEEABC	5.713608	0	0.002632
18	MEABC vs. TAPSO	4.984212	0.000001	0.002778
17	MEABC vs. SHADE	4.55873	0.000005	0.002941
16	ABCADE vs. MEEABC	4.315598	0.000016	0.003125
15	MEABC vs. ABCADE	3.76855	0.000164	0.003333
14	SHADE vs. MEEABC	3.525418	0.000423	0.003571
13	TAPSO vs. MEEABC	3.099936	0.001936	0.003846
12	MAPSO vs. TAPSO	2.796021	0.005174	0.004167
11	ABCNG vs. TAPSO	2.613672	0.008958	0.004545
10	MEABC vs. ABCNG	2.37054	0.017762	0.005
9	SHADE vs. MAPSO	2.37054	0.017762	0.005556
8	MEABC vs. MAPSO	2.18819	0.028656	0.00625
7	ABCNG vs. SHADE	2.18819	0.028656	0.007143
6	ABCADE vs. MAPSO	1.58036	0.114025	0.008333
5	ABCADE vs. ABCNG	1.398011	0.16211	0.01
4	ABCADE vs. TAPSO	1.215661	0.224114	0.0125
3	ABCADE vs. SHADE	0.79018	0.429423	0.016667
2	SHADE vs. TAPSO	0.425481	0.670486	0.025
1	ABCNG vs. MAPSO	0.182349	0.855309	0.05

Table 2: P-values Table for $\alpha = 0.05$

Holm's procedure rejects those hypotheses that have an unadjusted p-value ≤ 0.004167 .

2.2 P-values for $\alpha = 0.10$

i	algorithms	$z = (R_0 - R_i)/SE$	p	Holm
21	MEABC vs. MEEABC	8.084148	0	0.004762
20	MAPSO vs. MEEABC	5.895958	0	0.005
19	ABCNG vs. MEEABC	5.713608	0	0.005263
18	MEABC vs. TAPSO	4.984212	0.000001	0.005556
17	MEABC vs. SHADE	4.55873	0.000005	0.005882
16	ABCADE vs. MEEABC	4.315598	0.000016	0.00625
15	MEABC vs. ABCADE	3.76855	0.000164	0.006667
14	SHADE vs. MEEABC	3.525418	0.000423	0.007143
13	TAPSO vs. MEEABC	3.099936	0.001936	0.007692
12	MAPSO vs. TAPSO	2.796021	0.005174	0.008333
11	ABCNG vs. TAPSO	2.613672	0.008958	0.009091
10	MEABC vs. ABCNG	2.37054	0.017762	0.01
9	SHADE vs. MAPSO	2.37054	0.017762	0.011111
8	MEABC vs. MAPSO	2.18819	0.028656	0.0125
7	ABCNG vs. SHADE	2.18819	0.028656	0.014286
6	ABCADE vs. MAPSO	1.58036	0.114025	0.016667
5	ABCADE vs. ABCNG	1.398011	0.16211	0.02
4	ABCADE vs. TAPSO	1.215661	0.224114	0.025
3	ABCADE vs. SHADE	0.79018	0.429423	0.033333
2	SHADE vs. TAPSO	0.425481	0.670486	0.05
1	ABCNG vs. MAPSO	0.182349	0.855309	0.1

Table 3: P-values Table for $\alpha = 0.10$

Holm's procedure rejects those hypotheses that have an unadjusted p-value ≤ 0.01 .

2.3 Adjusted p-values

i	hypothesis	unadjusted p	p_{Holm}
1	MEABC vs .MEEABC	0	0
2	MAPSO vs .MEEABC	0	0
3	ABCNG vs .MEEABC	0	0
4	MEABC vs .TAPSO	0.00001	0.000011
5	MEABC vs .SHADE	0.00005	0.000087
6	ABCADE vs .MEEABC	0.00016	0.000255
7	MEABC vs .ABCADE	0.000164	0.002463
8	SHADE vs .MEEABC	0.000423	0.005919
9	TAPSO vs .MEEABC	0.001936	0.025163
10	MAPSO vs .TAPSO	0.005174	0.062083
11	ABCNG vs .TAPSO	0.008958	0.098533
12	MEABC vs .ABCNG	0.017762	0.177621
13	SHADE vs .MAPSO	0.017762	0.177621
14	MEABC vs .MAPSO	0.028656	0.229246
15	ABCNG vs .SHADE	0.028656	0.229246
16	ABCADE vs .MAPSO	0.114025	0.684147
17	ABCADE vs .ABCNG	0.16211	0.810549
18	ABCADE vs .TAPSO	0.224114	0.896456
19	ABCADE vs .SHADE	0.429423	1.288268
20	SHADE vs .TAPSO	0.670486	1.340971
21	ABCNG vs .MAPSO	0.855309	1.340971

Table 4: Adjusted p -values